ENGINEERING OUTLOOK
AT THE UNIVERSITY OF ILLINOIS

RESEARCH
EDUCATION
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ENGINEERING RESEARCH SUMMARIZED

The Engineering Experiment Station at the University of Illinois had a research income of more than $6,496,000 in the fiscal year ending in 1959. The staff of the College of Engineering consisted during that year of 526 faculty members with the support of 377 nonacademic staff members, such as laboratory mechanics, technicians, and office personnel, and 423 graduate assistants. They were engaged in 324 research projects. Of these, 211 were sponsored by outside sources, including 31 private companies, 16 industrial associations, 2 private foundations, and 51 federal and state agencies.

Of the nearly six and a half million dollars in research income, approximately $5,094,700 came from various federal government sources, $380,300 from industry, private foundations, associations, and operating agencies of the State of Illinois, and $1,021,000 from the general funds of the University.

These figures are a part of the information about engineering research at the University of Illinois, as contained in the *Summary of Engineering Research: 1959,* now available on request from the Engineering Publications Office. This *Summary* outlines the policies and operation of the Engineering Experiment Station and summarizes the research of each engineering department, project by project. The advantages of engineering research at a large university are illustrated by brief descriptions of groups and facilities outside the College of Engineering which cooperate with the engineering research program.

This is the second of an annual series. It is intended as a general guide to research in engineering at the University, and is not a detailed technical presentation of any specific area of work. For the convenience of those interested in more detailed information, publications are listed after each project and the names of the investigators in charge are given.

NOT EVEN HOUDINI . . .

Magic is not generally considered the province of the engineer. He deals with physical phenomena and reasonable explanations. Yet by some magic or other, electrical engineers at the University of Illinois are carrying on their educational and research functions in facilities designed by a department less than one-quarter their present size.

Fifteen years ago, in 1945, the Electrical Engineering Department had a staff of twenty, 196 undergraduate students, and 2 graduate students. Expecting an undergraduate enrollment of 400 in a more normal year, the Department requested a new building. Funds were made available, but post-war prices rose sharply. There was only money enough to build one-third of the building originally requested and approved. In 1949, the one-third building was completed. The Department had grown some in the four years since the request, but growth had been anticipated. Engineering could meet the Department's space requirements without reference to the occult.

Eleven more years have passed. The explosive expansion of electrical engineering in an age of missiles, computers, and super-accurate guidance systems has been followed by explosive expansion of electrical engineering education and research. The department that in 1945 had 20 staff members and 196 undergraduate students now has 91 faculty members, 79 nonacademic staff members, 1146 undergraduate students, and 222 graduate students. Growth of the research program has more than kept pace.

The job they are doing is a good one, but there are limits even to an engineer's magic. A planned addition to the Electrical Engineering Building would greatly relieve the crowding, but funds are not yet available.

The Universities Bond Issue, to be voted on by the people of Illinois next November, does not specify what funds shall be made available for what buildings — or even for which institution. But if the Universities Bond Issue passes, electrical engineers at the University will have brighter hopes for the addition to their building.

Their magic charms are wearing thin. They fear that soon engineering reality will force restriction of the number of electrical engineers that can be adequately trained, despite growing needs in industry and defense. The voters of the state need to be informed of the needs and importance of higher education so that they may decide the fate of the Universities Bond Issue wisely next November.

The final decision belongs to the people of Illinois.

THE BEST FROM THE BEST

The future of our civilization may depend on how well we develop and utilize our nation's "brainpower." In this regard, helping the superior student make the most of his ability is a challenge to all educators. The College of Engineering will begin a new program next fall to meet that challenge.

The Edmund J. James Scholar Program was initiated by the University for freshman students entering in September, 1959, to recognize and encourage outstanding scholarship. The program is expected to help attract outstanding high school graduates and develop their talents to the fullest.

The James Scholar Program operates in conjunction with undergraduate honors programs in the various colleges and schools of the University. Beginning in September of this year, the College of Engineering will have an Honors Program in Engineering. This program will provide the superior student with greater opportunities and greater flexibility than in the normal curriculum and a climate for deepened development.

Minimum requirements for the Honors Program for entering freshmen include admission to the University as a James Scholar. Honors students will be expected to maintain a grade point average of 4.5.

These students will be assigned to special advisors and be encouraged to satisfy course requirements by proficiency examinations or to move directly into advanced level courses when advisable. Special sections will be established for them in some courses. In these sections, the high level of student ability will make it possible to cover more material in greater depth than is normally possible.

Upperclassmen may have a portion of their normal curriculum requirements waived and other courses substituted. Special activities will also be available, including seminars and projects.

Honors students successfully completing their programs will have Honors status indicated on their diploma in acknowledgment of the special work they have done at the University.

EDUCATION THROUGH RESEARCH

Laboratory exercises in which the professor doesn't know the answer ahead of time will occupy some outstanding University undergraduate students in the coming months. Under grants from the National Science Foundation, approximately twenty undergraduates in Electrical Engineering, Theoretical and Applied Mechanics, and Chemistry and Chemical Engineering will work under the direction of faculty members in actual research projects. The work begins this summer and in some cases will extend through the coming academic year.

An event at Mechanical Engineering's Annual Industrial Night April 27 was presentation of Foundry Educational Foundation scholarships to four outstanding sophomores. Presenting the scholarships was C. F. Strom, vice president of Griffin Wheel Co. (left). Students who received scholarships were R. W. Kotrba (Chicago), C. H. Jones (Flossmoor), and C. H. Ernst (Gibson City). Prof. J. L. Leach (right) is faculty advisor of the student chapter of the American Foundryman's Society. G. R. Boyd (Urbana) was awarded a scholarship but was not present.

The purpose of this program is to interest superior students in research and to give them experience in using the scientific method and actual research procedures. The program is an additional way in which the College of Engineering is able to use its extensive research program to strengthen its educational function. The students' interest in their work should be heightened considerably with the realization that they are "playing for keeps" in their work, searching for new information, and not just going through the routine laboratory exercises.

The National Science Foundation grants will be administered by Professor W. E. Miller in Electrical Engineering, Instructor S. Russel Keim in Theoretical and Applied Mechanics, and Professor J. C. Martin in Chemistry and Chemical Engineering. The students will work on various projects under faculty members of those three departments.

In Electrical Engineering, a senior in engineering physics will work under Professor A. A. Dougal in the area of plasma physics and the problem of controlled thermonuclear reactions. In his work he will be dealing with gasses at temperatures comparable to those on the surface of the sun. A senior in Electrical Engineering will study the nonlinear microwave properties of plasmas, an area in which little work has been done to date. This will be a part of the microwave research program under the direction of Professor Paul Coleman.

In Theoretical and Applied Mechanics, eight students this summer will participate in the program, under the direction of Professors A. C. Bianchini, C. E. Taylor, H. T. Corten, and W. J. Worley. Their work will be in the areas of dynamics and vibrations and mechanics of solids. In each case, the work of the student will be associated with existing research programs but will be carried on as a problem in itself, exploring aspects of the general research program that might otherwise have to be neglected for want of staff.

The ten students in Chemistry and Chemical Engineering will be working in the fields of biochemistry, organic chemistry, and chemical engineering. The chemical engineers will work under Professor J. A. Quinn, who is directing the department's research program on fluidization, an important phenomenon in many chemical engineering operations.

NEW ENTRANCE REQUIREMENTS

Students wishing to enter the College of Engineering in September of 1963 will have to meet a new set of requirements, including more high school work than is now required in science, social studies, and languages.

Engineering requires a stronger background in mathematics and science now than ever before. At the same time, the increasing social responsibilities of the engineer require an understanding of men and society. This understanding can be aided by a study of the social sciences and humanities. These developments mean that the high school should participate in preparing the student for a professional career in engineering even more than in the past. High schools offer a wide choice of courses in languages, the social sciences, mathematics, the sciences, and English, and are capable of such participation.

The new requirements emphasize the importance of good preparation in high school in all these basic areas of study. Meeting them will give the student the necessary background for almost all fields of study in any university.

Details of the requirements are in a pamphlet, "New Entrance Requirements," recently published by the College of Engineering. Copies of this pamphlet are avail-

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ORDER FORM — send with remittance to Engineering Publications, 114 Civil Engineering Hall, University of Illinois, Urbana, Illinois

☐ Bull. 456, *Titania Opacified Porcelain Enamels,* R. D. Shannon and A. L. Freidberg. *One dollar.*

☐ Circular 68, *A Comparison of the Performance of Various Room Heating Units Used in the I=B=R Research Home,* Warren S. Harris and L. N. Montgomery. *Fifty cents.*

☐ Reprint 61, *Progress Reports of Investigation of Railroad Rails,* Ralph E. Cramer. *Fifty cents.*

☐ *A Summary of Engineering Research: 1959.* No charge.

☐ *Engineering Departmental Reports and Theses: 1958-1959.* No charge.

☐ *New Entrance Requirements.* No charge.

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able to interested parents, students, and educators, on request from the Engineering Publications Office.

The requirements are:

Subject	*Required Units*	*Recommended Additional Units*
English	3	1
Algebra[1]	2	
Plane Geometry	1	
Trigonometry[1]	½	
College Preparatory Mathematics		as available
Science[2]	2	1
Social Studies	2	1
Language[3]	2	as available[4]

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[1] Students who have only one unit in algebra and one unit in plane geometry may be admitted on condition that the deficiency is removed in the first year.

[2] Required science must include at least one unit each from two of the following subjects: physics, chemistry, and biology. Botany and zoology may be substituted for biology. General science may not be used as a required science subject, but may be used as an elective subject.

[3] Required language must be two units in one language. Students deficient in language may be admitted on condition that the deficiency be removed during the first two years.

[4] It is recommended that additional credit be earned in the same language that was presented for entrance credit. However, if the two required units of language are Latin, the additional credit should be in a modern language.

MESSAGES FROM THE SKY

University of Illinois antenna research went to new heights recently when satellite Transit I-B flashed across the skies bearing a spiral antenna developed by the Electrical Engineering Department's Antenna Lab. Making a protruding antenna unnecessary, this spiral can receive radio messages over an extremely wide band of frequencies, from 54 to 216 megacycles. Spirals and other unique antenna designs developed at the University are being used by several research groups for radio direction finding, radio astronomy, and moon-echo study.

The Antenna Laboratory has conducted work on basic electromagnetic theory and applications to antennas for high speed aircraft for the past ten years. This work has involved both the transmission and reception of electromagnetic waves of various types. The University of Illinois Foundation holds a number of patents in the antenna area, as a result of work conducted in the University's Antenna Laboratories.

Other research programs on radio wave propagation and reception include facilities at the University for radio direction finding which are among the most extensive and complete in the country. Two antenna sites are in operation, with three antenna arrays. The largest is a wide-aperture Wullenweber-type array 990 feet in diameter on a 40-acre site with a laboratory building at the center of the antenna array. The other antennas include two small-aperture Adcock and satellite tracking installations located on a separate 80-acre site. The aim of the research is to advance the art of direction finding by comparing the various systems and to obtain basic information about the propagation of ionospherically-reflected radio waves.

Two other antennas deserve mentioning. The 28-foot parabolic Moon Beam Antenna, mounted on the Electrical Engineering Building, is used to receive signals reflected off the surface of the moon from transmitters in New Jersey and Canada. These radio signals, taking only 2½ seconds to make the half-million mile journey, furnish valuable information about the ionosphere.

The other antenna is the great radio telescope being constructed near Danville, Illinois. Receiving elements, mounted on towers 155 feet above the 400- by 600-foot ravine which serves as a huge reflector, will consist of cone-shaped logarithmic spiral antennas which are near relatives of the one now on Transit I-B. Construction of the radio telescope will be completed by fall. Addition of this installation will give the Electrical Engineering Department one of the most complete antenna facilities in this country.

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